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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

In the Matter of:

Advanced Television Systems  
and Their Impact on the  
Existing Television Broadcast  
Service

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MM Docket No. 87-268

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COMMENTS OF  
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The views expressed here are those of the author only.

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OPEN VIDEO ARCHITECTURE:  
COMMENTS ON THE FCC'S NOTICE OF INQUIRY  
ON ADVANCED TELEVISION SYSTEMS

W. Russell Neuman

November 18, 1987

My comments address a series of related issues which I believe the Commission should consider in the matter of advanced television systems. I will not recommend a specific technological approach or a particular vendor for the provision of advanced television technology. I will focus instead primarily on procedural issues.

I am a research social scientist. For the past twelve years at Yale University and the Massachusetts Institute of Technology I have been conducting behavioral studies on how audiences respond to television and related media technologies such as videotex and interactive video. I also conduct research on regulation and market behavior in broadcasting and telecommunications. The views expressed here are my own personal opinions and not those of the Massachusetts Institute of Technology, the Media Laboratory, the Advanced Television Research Program or the Research Program on Communications Policy with which I am currently associated.

My remarks are organized around the concept of Open Video Architecture (OVA) which, I believe, represents a coherent regulatory strategy for dealing with rapid technological change. OVA involves five key concepts: 1) Enhanced Service, 2) Smart Receivers, 3) Industry Negotiated Standards, 4) Service Class Structure, and 5) Holistic Regulatory Perspectives. Some of these ideas have been noted and discussed in some detail in the Notice of Inquiry dated August 20, 1987. Other elements, however, are strangely absent or receive only passing notice in the NOI.

Open Video Architecture draws on a parallel concept in telecommunications known as Open Network Architecture (ONA). Common carrier regulation over the past several decades has confronted a difficult tension between the need to protect the viability of a common, inexpensive, universally available telecommunications service and the need to encourage new and advanced telecommunications services for those institutions and individuals who could make good use of them and are willing to pay for attendant additional costs. Reluctant to determine an inflexible package of tariffed advanced services a priority, and faced with failure to define workable abstract distinctions between basic and enhanced services (in Computer Inquires I and II), the Commission opted

for an aggressive strategy of forcing the decision-making process back into the marketplace where it belongs. The Commission set up procedures for various industry players to work out among themselves the technological interfaces necessary for a flexible and competitive system of service provision. The dominant Bell Operating Companies and AT&T are motivated to participate because such cooperation is required if they are to participate themselves in new markets for advanced services. Other vendors are motivated by the prospect of access to an established network of customers with the basic technology of communications already in place.

In Open Network Architecture the Commission struck a balance between the need to protect the viability of the existing communications system and the need to encourage experimentation and technological advancement without making the Commission itself the arbiter of which specific technologies and services best serve the public interest. In my view, a parallel philosophy of Open Video Architecture will best serve the transition to an economically viable and technically flexible set of standards for the next generation of video technology.

The parallel between ONA and OVA requires a cautious appraisal. Any parallel of this sort will surely break down and could lead to misleading conclusions if pushed too far. Furthermore, at this time the speculations on the possible success of ONA in telecommunications vary widely because of Judge Harold Greene's recent ruling and difficulties in operationalizing a workable ONA system. Nonetheless, I think the parallel is an instructive one, and that the underlying regulatory strategy represents a promising, balanced and economically realistic model for the Commission in the case of advanced television systems.

1) Enhanced Service. Despite the language in the NOI which speaks of initiating a "wide-ranging inquiry" (paragraph 3) and an urging that commenters consider "the broad context within which action may soon be taken to bring the benefits of advanced television technology to the public" (paragraph 114), the focus of the NOI is strikingly narrow. It is clear that the prospect of High Definition TV, particularly the advent of the Japanese 1125-line system is the real-world stimulus for this NOI. But the technological prospects for advanced video systems involve more than simply higher quality audio and screen displays. I urge the Commission to take the phrase "Advanced Television Systems" at face value and invite the industry and the technical community to explore a variety of new technological functionalities (including HDTV) under the rubric of Enhanced Service.

One of the central premises of my thinking and research in this area is the notion of an underlying trade-off between quality and quantity. If new technologies allow us to compress more information into a given bandwidth, we must decide if we want to use that capacity to improve the quality of a given signal, or to provide more diverse sources of programming at the same level of transmission quality previously

available. If television receiver quality has improved sufficiently to permit a relaxation of the UHF Taboos, we confront the possible availability of substantial new piece of usable spectrum real estate. In my view, the Commission should consider a variety of uses for that spectrum rather than presuming it will be divided up among existing broadcasters for purpose of picture enhancement. It may be that the public would prefer a larger quantity of available over-the-air channels rather than improved picture quality of existing channels or perhaps combination of the two. Improved picture quality may be more relevant for one type of programming content, a movie channel for example, and less relevant for another, perhaps an independent station specializing in old reruns. It is the kind of complex and fluid allocation process better handled by markets than administrative fiat. There is one passing reference to the prospect that the public might be well served by a greater diversity of broadcast signals in paragraph 102 of the NOI. But the matter is entirely overwhelmed by the detailed discussion of picture quality and transmission standards. Furthermore, there is no discussion at all of the possibility that signal processing techniques could be used to provide multiple channels of current-quality video within a 6 MHz bandwidth. These are important matters. Their absence from the NOI is a matter of some concern.

The notion of enhanced service, like OVA, has a parallel in telecommunications. In the old days the definition of telecommunications service was simple. A common term was POTS, Plain Old Telephone Service, referring to straightforward, undifferentiated access to the switched voice network. Now, computers, data and graphic communication have evolved into a complex pattern of enhanced telecommunications services. One widely circulated list proposes 118 unique enhanced "basic service elements" for Open Network Architecture (August 1987 BOC Special Report on Enhanced Service provider Requests for Network Capabilities, Bellcore). I believe that in time the same phenomenon will emerge in the video domain. I believe the FCC would be wise to anticipate this development in the context of the Advanced Television Systems proceedings.

One of the most exciting new developments in the video domain is interactivity. People need not simply sit passively in front of their sets but can interact with the flow of images and graphics in new ways. Interactive videodiscs, teletext and two-way cable were very early and not entirely successful experiments along these lines. But it should be acknowledged that the limited success of early prototypes does not mean the underlying concept is not valid. There were numerous unsuccessful early experiments with pay television and home video recording before the right combination of technology, economics and marketing was discovered. It may be that two-way television will involve a telephonic uplink and a specially encoded (addressable) broadcast downlink. It may be that some programming will be broadcast in other than real time, locally stored and viewed at will (a variation on current VCR time-shifting practices.) It may be that some programming will involve a interaction mixture of locally stored video and data and a broadcast signal.

If the technical parameters of the NTSC broadcast signal are going to be relaxed or made voluntary, I believe that some other public benefits in addition to improved quality pictures are possible and desirable. Through a broader definition of enhanced video service, the Commission can nurture such initiatives.

2) Smart Receivers. OVA implies the existence of a core set of technological specifications for television broadcasting. But the specifications are flexible and "open" to further modification and enhancement. The ACTV proposal from NBC/RCA/Sarnoff Labs, for example, embellishes the core NTSC signal with three additional components, a time expanded side panel signal for a wider picture, a horizontal luminance detail component, and a vertical-temporal helper signal. It is not clear as of this writing whether in actual broadcast conditions such embellishments might perceptibly degrade the picture on older NTSC sets. But rather than playing the role of arbiter of what is acceptable degradation and what is sufficiently enhanced video quality, the Commission may choose to use an open receiver architecture approach to stimulating research and market experimentation.

The notion of open architecture also draws from the history of the computer industry. IBM, for example, had always been quite proprietary about the development of new computing technologies. Apple Computer took the initiative to "open up" the technical specifications of their personal computers to encourage the technical community to develop software and add-on boards to enhance the value of their product. The Apple strategy proved to be quite successful. Numerous inventors and entrepreneurs developed and marketed valuable enhancements to their core technology. In time, even IBM began to experiment with a similar strategy of open architecture with their PCs. Especially in times of dramatic technological change and upheaval, it would seem to be a sound strategy.

The smart receiver offers the prospect of a bridge from current technologies to enhanced ones. As I understand the industry standard, television sets are replaced on average every seven years. So as an absolute minimum one would expect at least a seven to ten year transition period during which NTSC compatible broadcasting would be highly desirable. One would expect the further continuation of NTSC compatible broadcasting for a longer period as well, depending on the nature of audience demand. One would expect newer smart receivers to recognize signature characteristics of the incoming signal (some compatible, some not compatible with NTSC) and use the additional information for enhanced video services such as multichannel sound, wider aspect ratios, improved picture quality, specialized narrowcast or interactive services. The bridge concept, as developed by Professor Schreiber in his Analysis and Recommendations in response to this NOI, suggests that appropriate standards be defined in a number of service classes. Those households who had already purchased smart receivers would be able to take advantage of

the full range of broadcasting services in different service classes. The transition from a NTSC compatible to a non-compatible standard would be an option to each broadcast licensee. They would be in a position to weigh the costs and benefits, test the market and respond accordingly. It would seem to be a more appropriate procedure than an administratively mandated set of deadlines for transitions of some sort.

3) Industry Negotiated Standards. A central aspect of OVA is the idea that with an open forum for industry discussion and a level playing field allowing each interested party to contribute to and draw from the accumulated research base, the prospects of a workable and flexible set of technical standards are increased. For good and appropriate reasons, the FCC has in recent years been reluctant to play the role of technical evaluator among alternative technologies. For one thing the process is likely to be long and involved with awkward and unfortunate delays in bringing forth technical ideas to use. For another, once a decision is made, any number of non-selected vendors are likely to challenge the decision in the courts leading to further delay.

The compromise between a potential chaos of no common technical standards and a regulator-mandated one is a process of industry negotiation within a clear set of Commission guidelines and deadlines for the development of technical standards within different classes of enhanced service.

There already exist a number of appropriate bodies such as the American Television Standards Committee who are well positioned to facilitate the process of industry negotiated standards. I think the Commission would be well advised to take advantage of their experience and established structure.

4) Service Class Structure. In line with the notion of industry negotiated standards, the Commission could set forth a clear set of classes for enhanced service, perhaps along the following lines: 1) Receiver Compatible Advanced Broadcasting Systems -- able to be viewed by currently existing NTSC sets with minimal or no degradation or distortion but capable of providing enhanced service to advanced sets, 2) Channel Compatible Advanced Broadcasting Systems -- noncompatible with existing sets, but capable of offering enhanced service within the existing 6 MHz channelization scheme, 3) Receiver-Compatible Extended Bandwidth Advanced Broadcasting Systems -- compatible with existing NTSC sets with minimal or no degradation or distortion but requiring supplementary transmission bandwidth beyond 6 MHz for enhanced service, and 4) Noncompatible Extended Bandwidth Advanced Broadcasting Systems -- unable to be viewed by existing sets but capable of providing enhanced service in bandwidths beyond 6 MHz.

Experimentation in the tradition of the widely cited "Back to the Future" paper (M. Fowler, et al., Federal Communications Law Journal,

August, 1986) would be encouraged within each service category. After an appropriate period, deadlines would be set for the industry to come to agreement on a set of core and peripheral technical components for each class. Core components would be established for the benefit of receiver manufacturers. Manufacturers and consumers would be able to identify a common core of functionalities for each service class. Peripheral components represent the continued open character of the system architecture and identify a more fluid set of options, special features and extras which set manufacturers and broadcasters could test in the marketplace. At later dates, with appropriate feedback from the manufacturing community and market responses, the Commission could migrate certain components and functionalities from a peripheral to a core status.

The particularly advantageous character of the service class concept is that it removes the Commission from the "direct line of fire" in attempting to determine to what extent compatible or non-compatible systems better serve the public interest at each point in time as technologies evolve. Those broadcasters who are convinced that the enhancements available through a non-compatible technology are sufficiently superior, are free to market such a service. If such a service requires more than a 6 MHz channel, there are natural market impediments to proceeding, that is, in obtaining access to additional spectrum space in the marketplace. Thus spectrum efficiency is protected by market rather than administrative mechanisms.

5) A Holistic Perspective. The spirit of this brief commentary is to draw attention to some parallel developments in the fields of telecommunication and mass media regulation in a time of dramatic technological change. We have had the opportunity to conduct some limited research on subjective responses of expert and non-expert viewers to several advanced video systems. We have also worked on stereo audio in television, audio quality in recorded media, interactive news and entertainment technologies, videotex and hard-copy display technologies for pictorial and graphic communications. Some general lessons have been learned from this research enterprise as a whole and I would particularly like to draw the Commission's attention to several of them.

One of the first projects we conducted was a retrospective assessment of previous attempts to predict the demand for and use of new media technologies. We found that no single research technique was a good predictor of how the marketplace would actually evolve. We noted particularly awkward and incorrect predictions for the development of picturephone, quadraphonic sound, videotex, video games and video discs. Such analyses provide a humbling experience for the would-be researcher who attempts to assess the relative merits of new communications technologies. We continue with our research as we believe important information about psychophysical and subjective responses to media can be derived. Such research can inform the development of advanced

television systems, but it cannot determine it. There are several reasons for this.

For one, people's experience and expectations influence their ability to discriminate among alternative levels of quality. We may find, over time, that the general public becomes increasingly sensitive to degradation or more demanding of audio or video displays. For another, there is a strong interaction between the type of programming being tested and people's sensitivity to display quality. Laboratory research based on test patterns may not predict market phenomena as individuals decide among alternative technologies and alternative programming in natural settings. For another, as people come to use broadcast media in different ways, interactively, for example, such functions might lead to a different set of technical preferences within the general public.

I hope the Commission, its advisory committees and the industry at large will be able to stimulate and sponsor a broad range of exploratory research on the human-uses side of advanced television systems. I do not believe, however, that any single study or set of studies will provide sufficient evidence about public interest and preferences among new media to serve as grounds for a determinant regulatory selection of one standard and the exclusion of others.

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An underlying theme of this commentary has been parallel developments in telecommunications and broadcasting. I think it is appropriate for the Commission to address the convergence of these two sectors directly. Increasingly, as a result of optical fiber and other prospects for the delivery of video services through the telecommunications network, the telephone industry has been paying closer attention to broadcasting and mass communications in general. In turn, broadcasters and the cable industry have been following developments in telecommunication more closely. One recent example of this convergence is Docket 87-266 on telephone-cable cross-ownership. There are many others.

It is striking when one reads the Advanced Television Systems NOI, that the discussion focuses so heavily on traditional broadcasting and spectrum allocation concerns. It may be that the telephone industry in the next decades will become a major player in the delivery of entertainment and information services. Rather than rely on the traditional distinction between spectrum broadcasting, and wire-line, switched telephony, I think the Commission would be well advised to explore how combinations of telephonic and traditional broadcast service could be coordinated to provide the greatest variety of programming and other enhanced services to the public at the lowest possible cost.



We confront a series of fascinating options, at this point in time, for the development of enhanced technologies for public communication. The discussion within the industry and strongly reflected in the Commission's NOI is that the future of television is HDTV. Our instinct is to take what we know of television and double the number of scan lines and make the picture dramatically wider. From my perspective, that represents a laudable but incomplete response. When television first became available we built on forms of communications with which we were already familiar. The content of television in the early days was drawn from reformulated radio programs and stage performance. The proscenium stage and curtain were heavily used, although no longer necessary. They were the familiar vestiges of the previous generation of technology. As we develop advanced television systems, in my judgment, we would be wise to look beyond brighter colors and wider screens.

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